

Interoperability – The Software Unicorn

Regional Connector Transit Corridor Project (RCTC)

Brindusa Dumitrascu

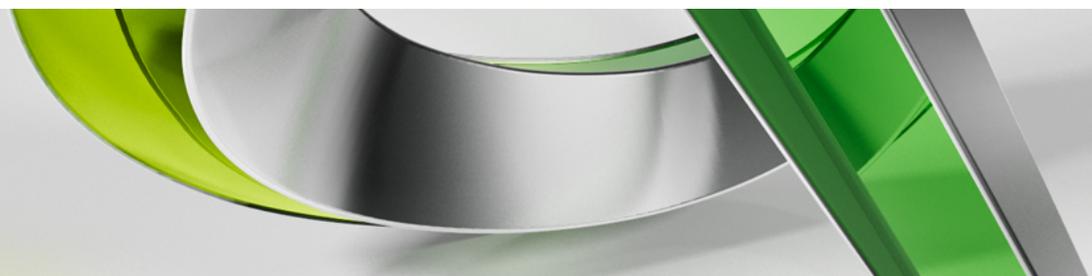
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About Us

Brindusa Dumitrascu

- BIM Specialist – Mott MacDonald, Los Angeles

Otto E. Stallworth III

- Design Coordinator – Mott MacDonald,
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Mott MacDonald

- Global engineering, management and development consultancy focused on guiding our clients through many of the planet's most intricate challenges
- Opening opportunities with connected thinking
 - www.mottmac.com
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Class Summary

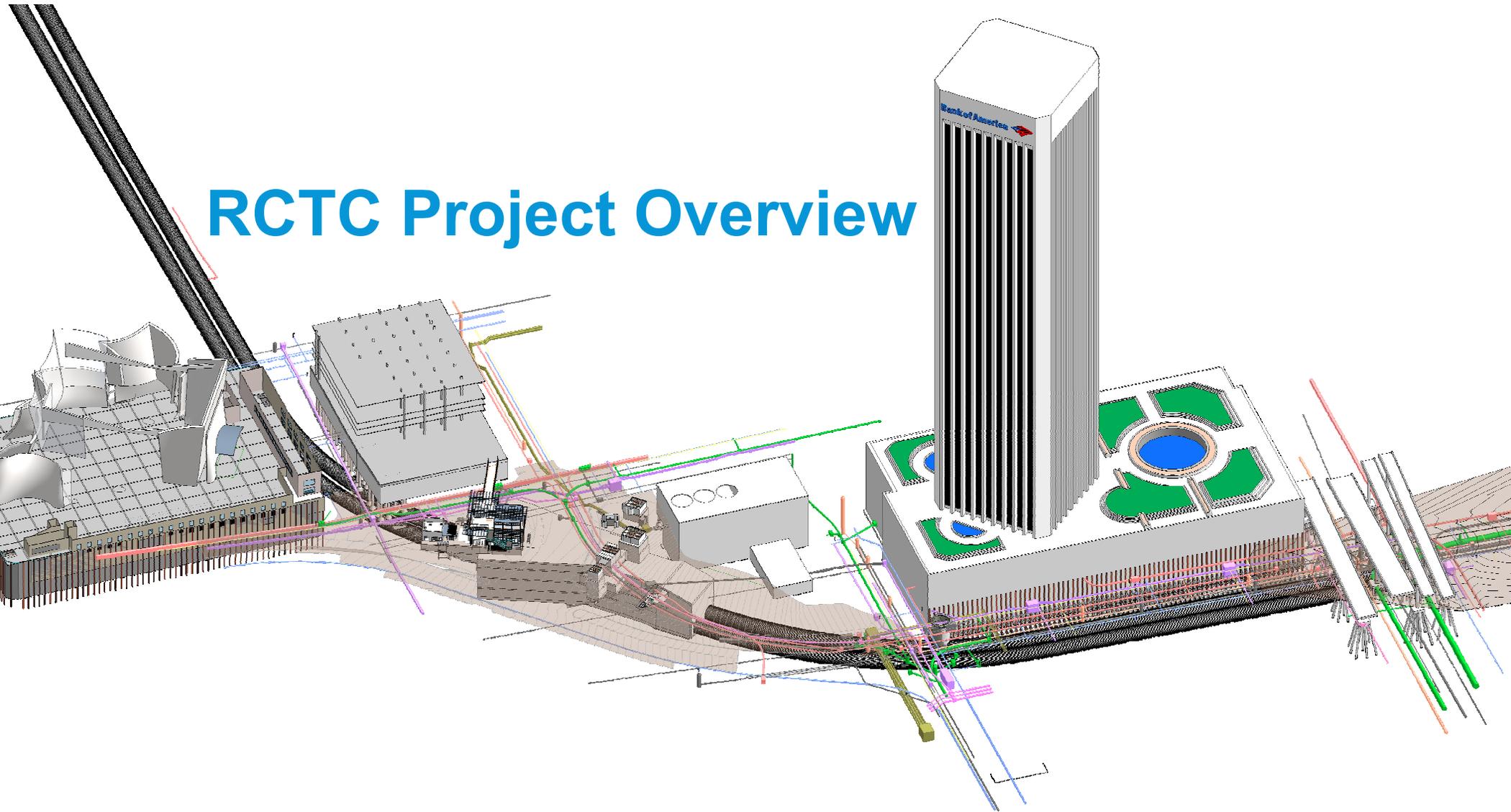
- Case study of the Los Angeles Regional Connector Transit Corridor Project and the workflows applied to integrate the Autodesk and Bentley platforms.

Key learning objectives

At the end of this class, you will be able to:

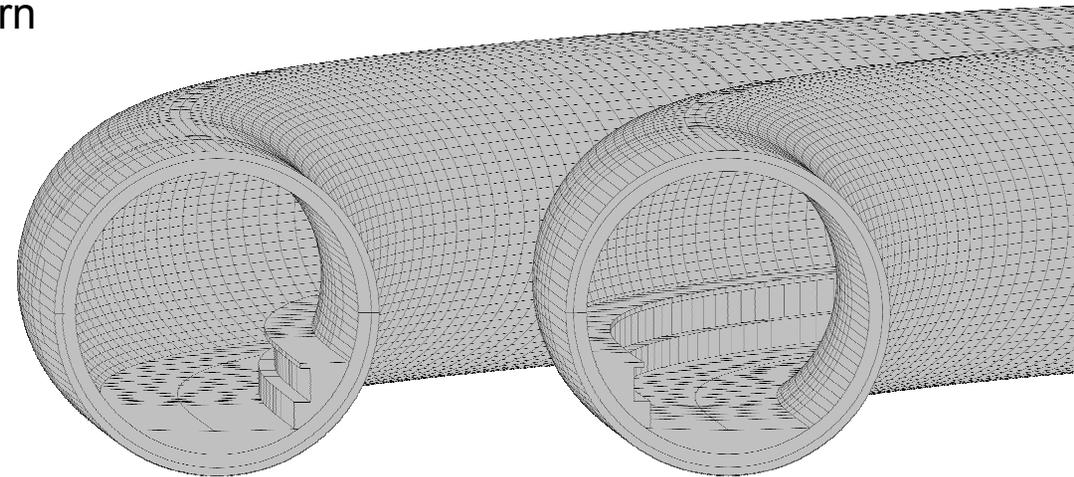
- Understand the Revit limitations
- Learn How to Bring Civil 3D Content into Revit
- Learn How to Bring Revit Content into Civil 3D
- The Future of the Software Unicorn

RCTC Project Overview



RCTC Project Overview

- Design-build contract - \$1.55 billion
- Connects Metro's existing Gold Line Little Tokyo/Arts District station to it's 7th Street/Metro station downtown Los Angeles
- Project duration – 2016-2021
- Project length – 1.9 miles
 - 1 mile of twin tunnels and SEM Cavern
 - 0.7 miles of cut and cover tunnel
 - 0.2 miles of at-grade alignment
- Three new stations:
 - 1st St/Central Avenue
 - 2nd St/Broadway
 - 2nd Pl/Hope St



California Map



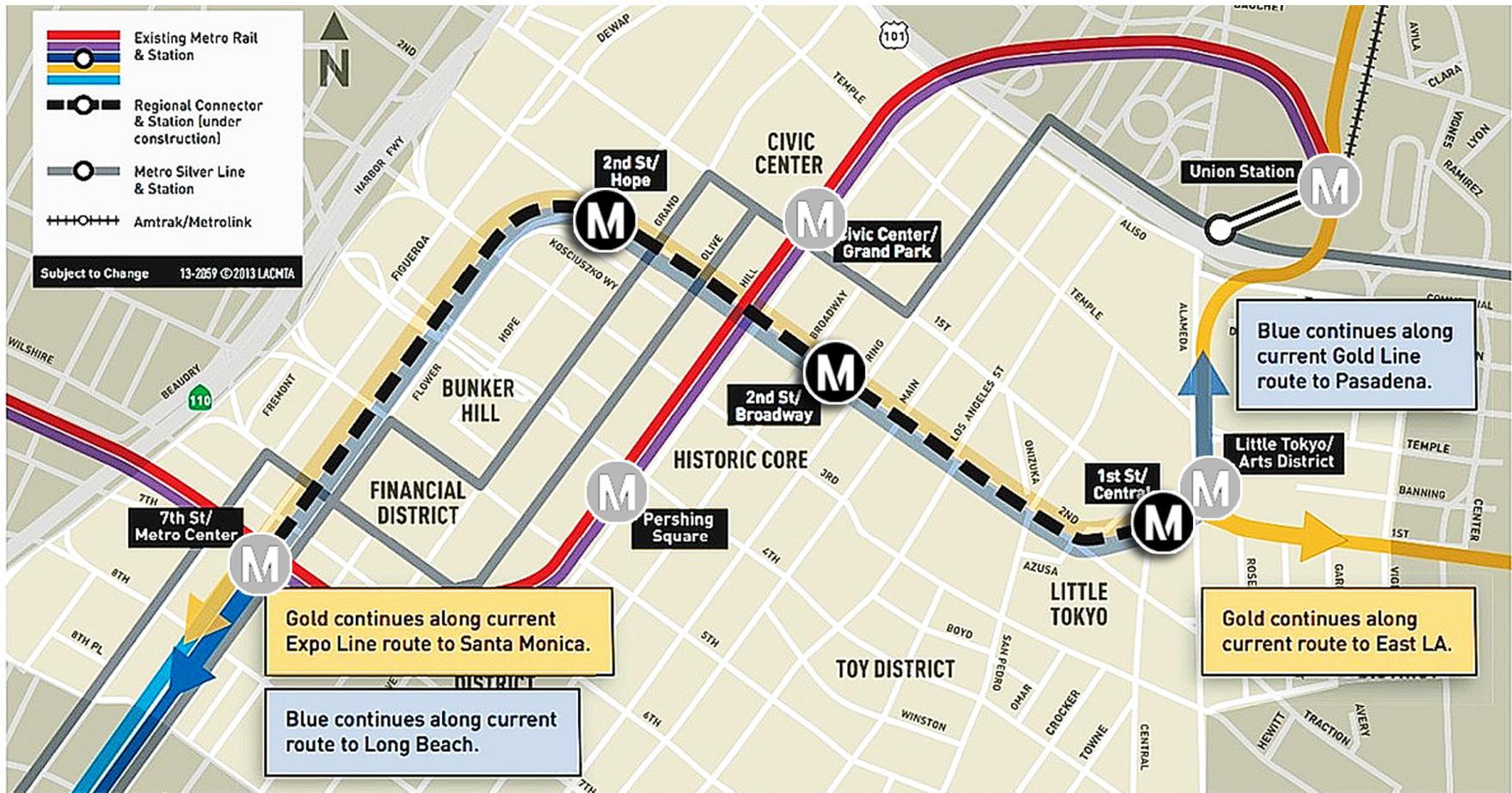
Los Angeles Map



Los Angeles Metro Map



RCTC Alignment Map



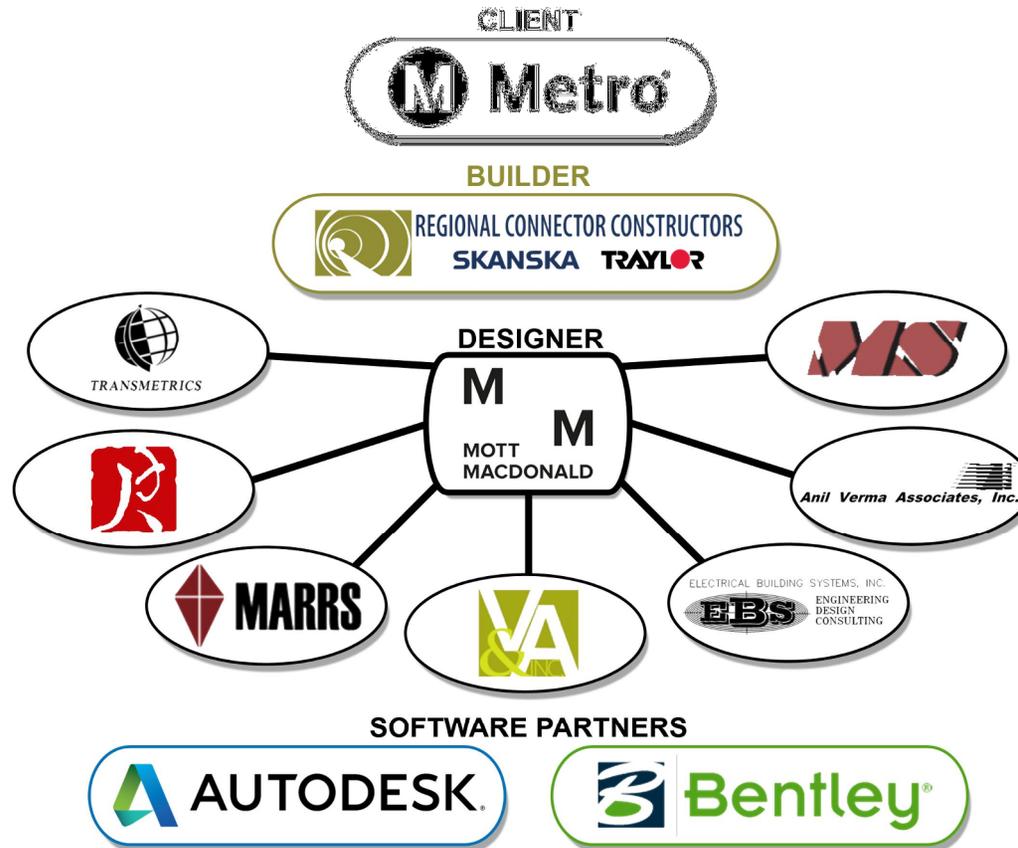


Collaboration

- Lead designer: Mott MacDonald (MM)
 - 15 MM offices across North America
 - 20 sub-consultants
- Constructor: Regional Connector Constructors (RCC) joint venture
 - Skanska USA Civil West California District, Inc.
 - Traylor Bros, Inc. (Evansville Indiana based)



Diverse Collaboration Team



Locations of Contributing Project Team

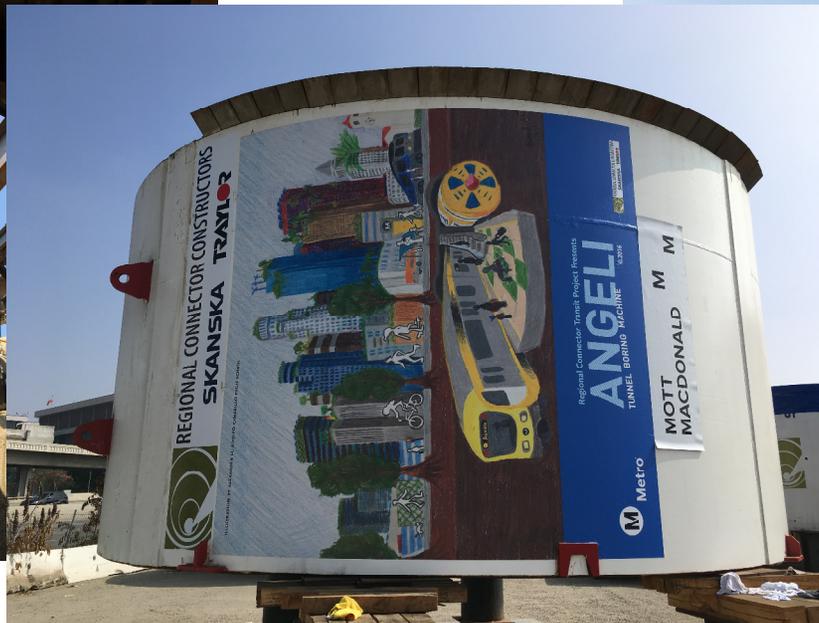


Project Progress

- <https://www.metro.net/projects/connector/>



Utility Relocation

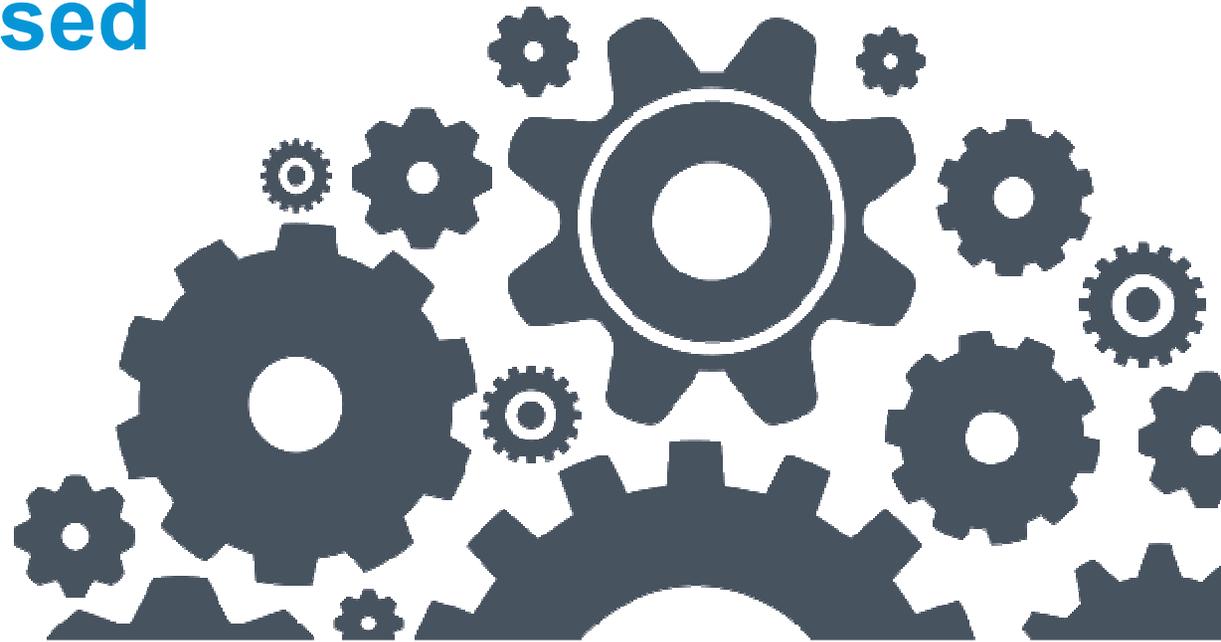


TBM Ring



1st/Central Cut & Cover Station

The Technology Used

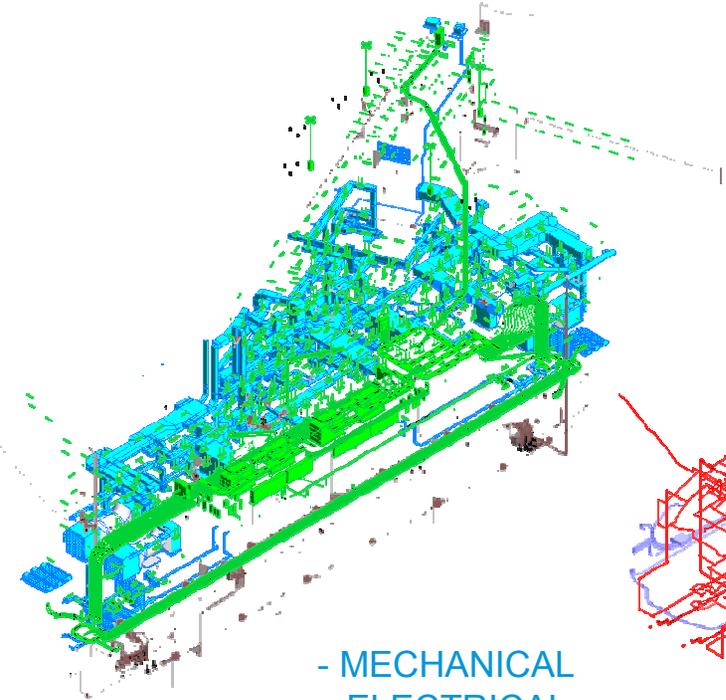


The Technology Used

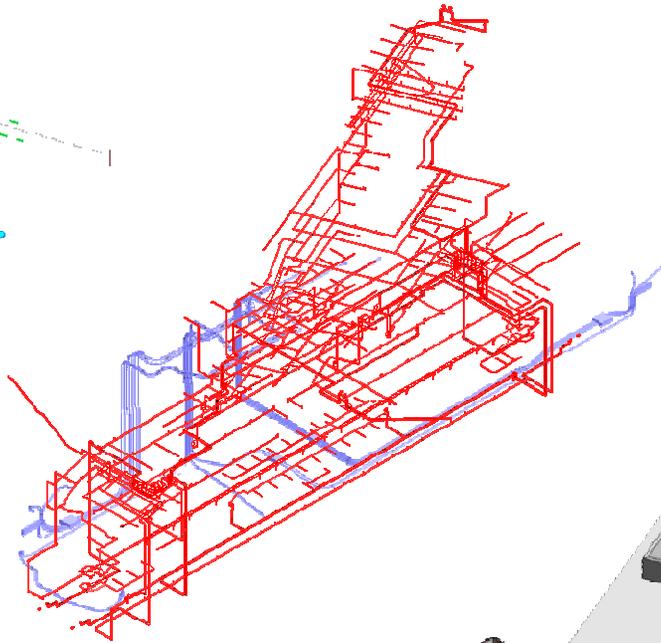
- File Sharing Platform:
 - ProjectWise
- Modelling Software (main design tools):
 - Revit 2014 – stations (architectural, structural, mechanical, electrical, plumbing)
 - AutoSprink – stations (fire protection)
 - Civil 3D 2014 – topo surface, utilities, tunnels
 - Navisworks 2014 – clash detection
 - BIM 360 Glue – model
- Design Review Software:
 - Bluebeam Studio – live review sessions



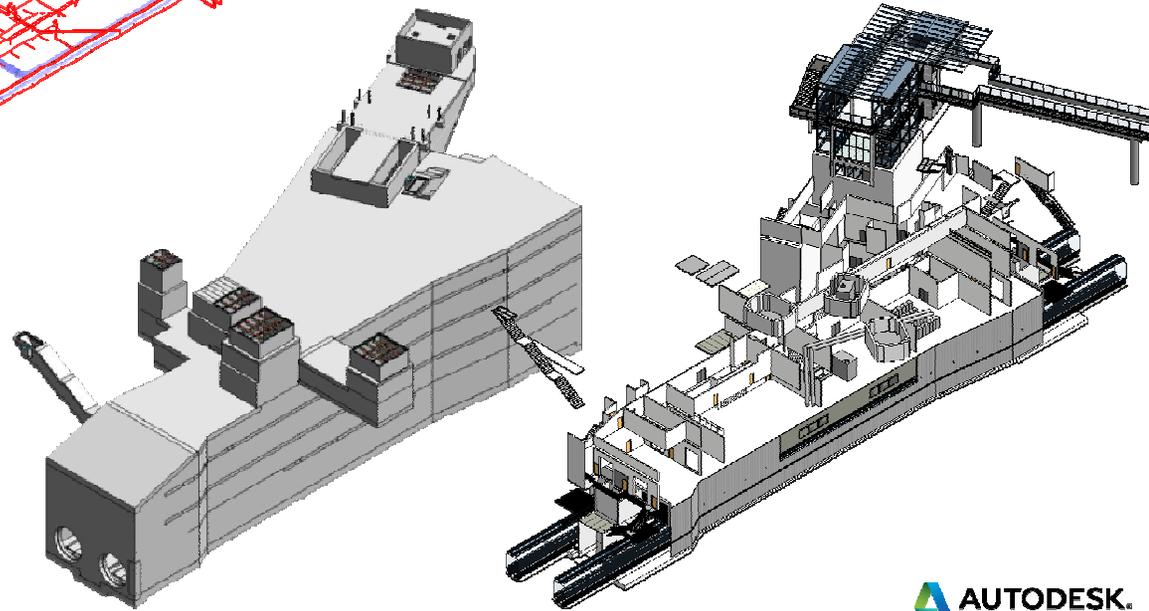
Revit Models



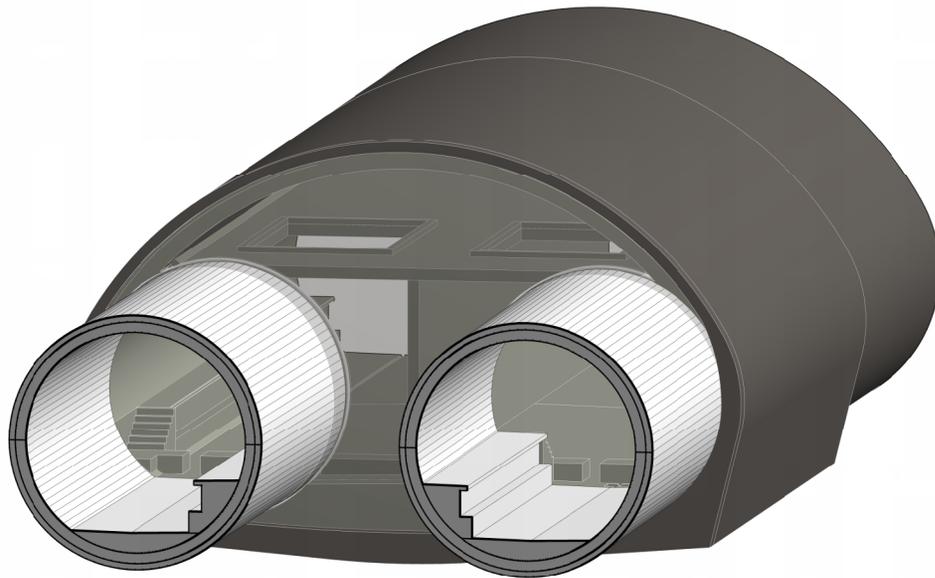
- MECHANICAL
- ELECTRICAL
- PLUMBING
- FIRE PROTECTION
- TRACTION POWER



- STRUCTURAL
- ARCHITECTURAL



Revit Models

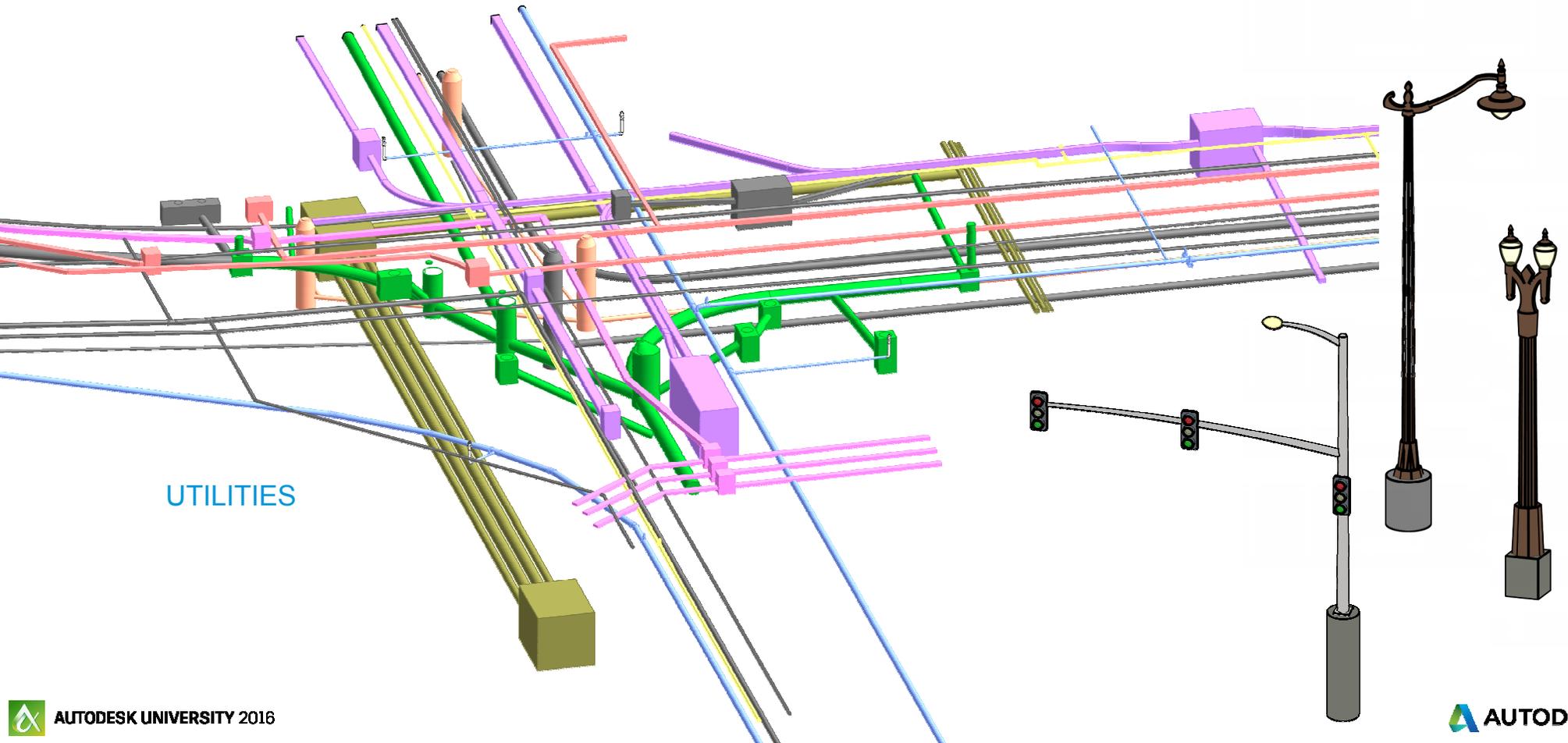


SEM TUNNEL



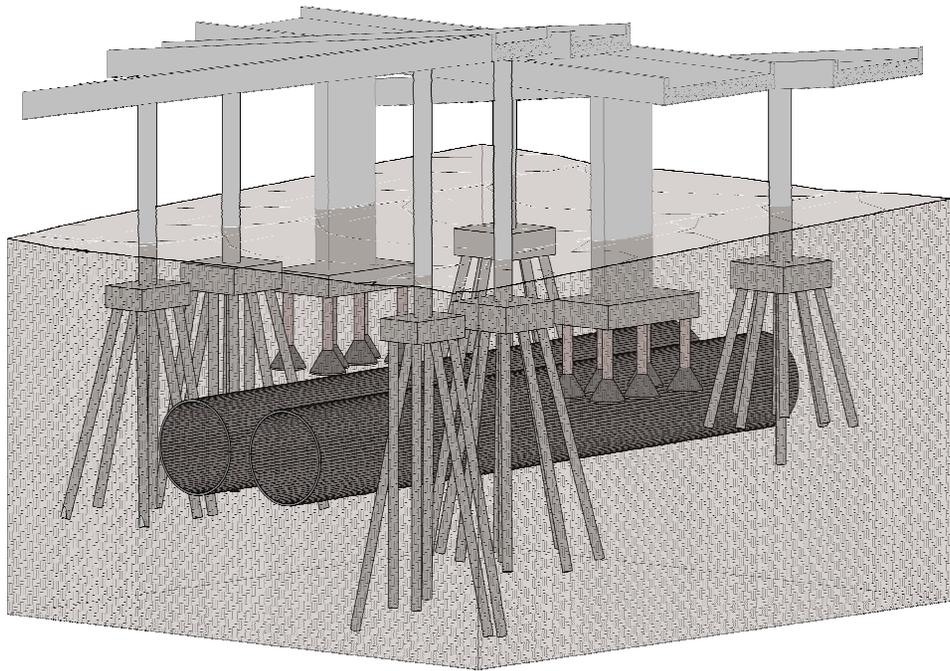
EXISTING BUILDINGS

Civil 3D Models

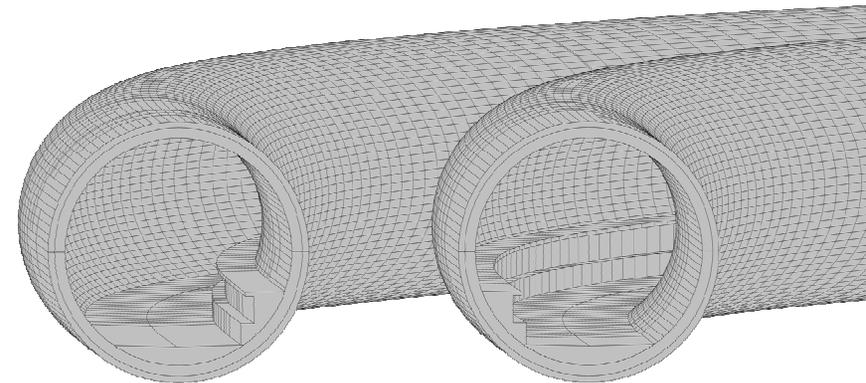
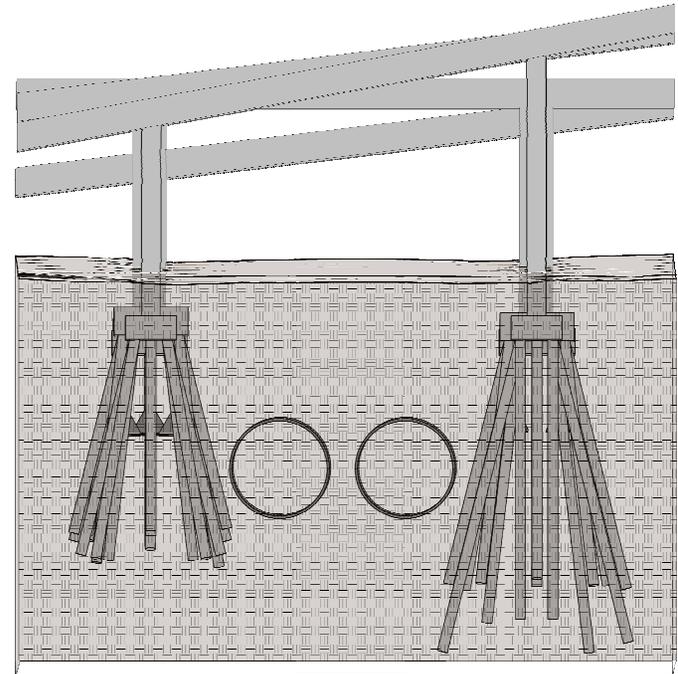


UTILITIES

Civil 3D with Revit Models

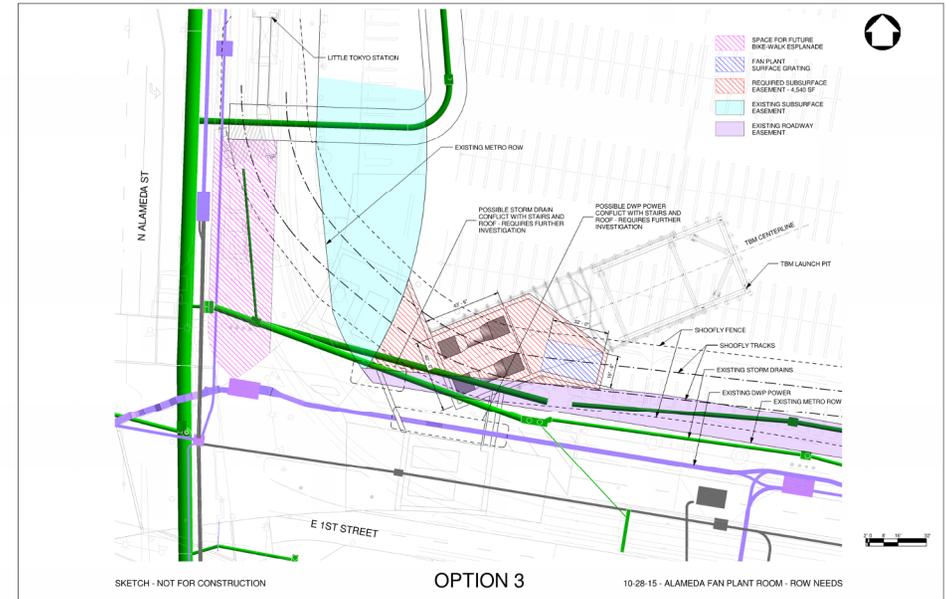
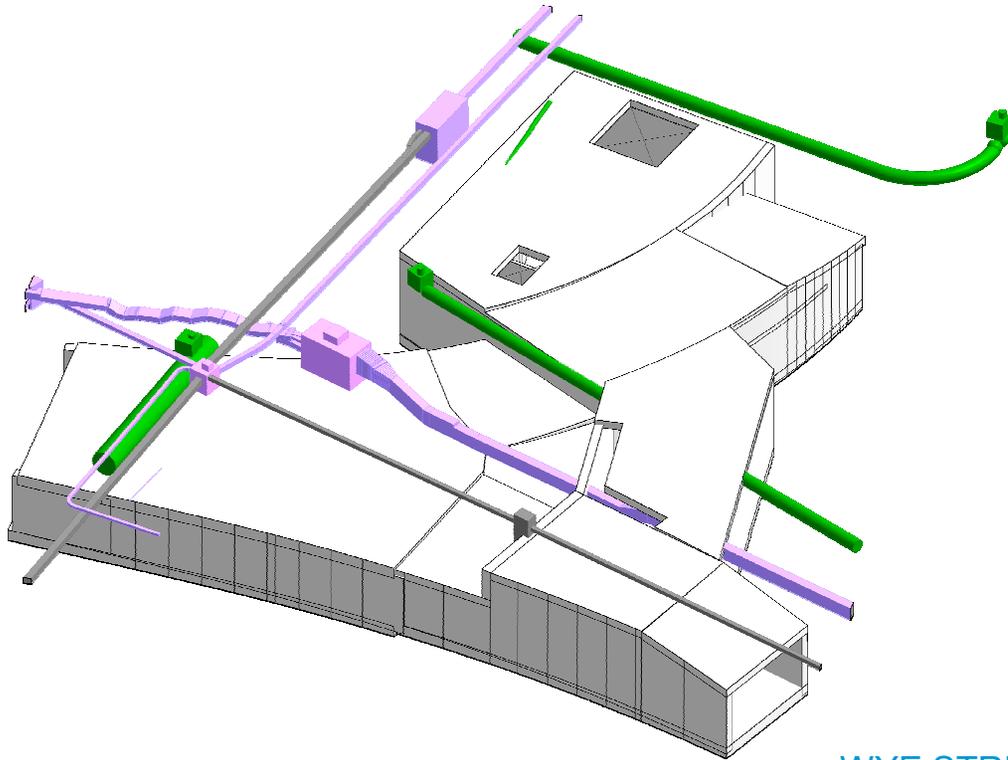


BRIDGES/TOPOGRAPHY



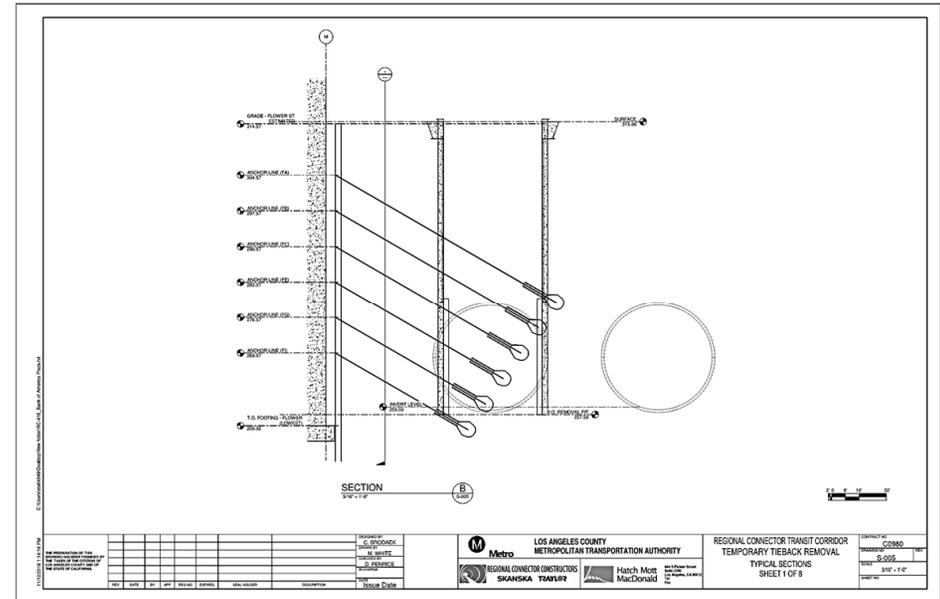
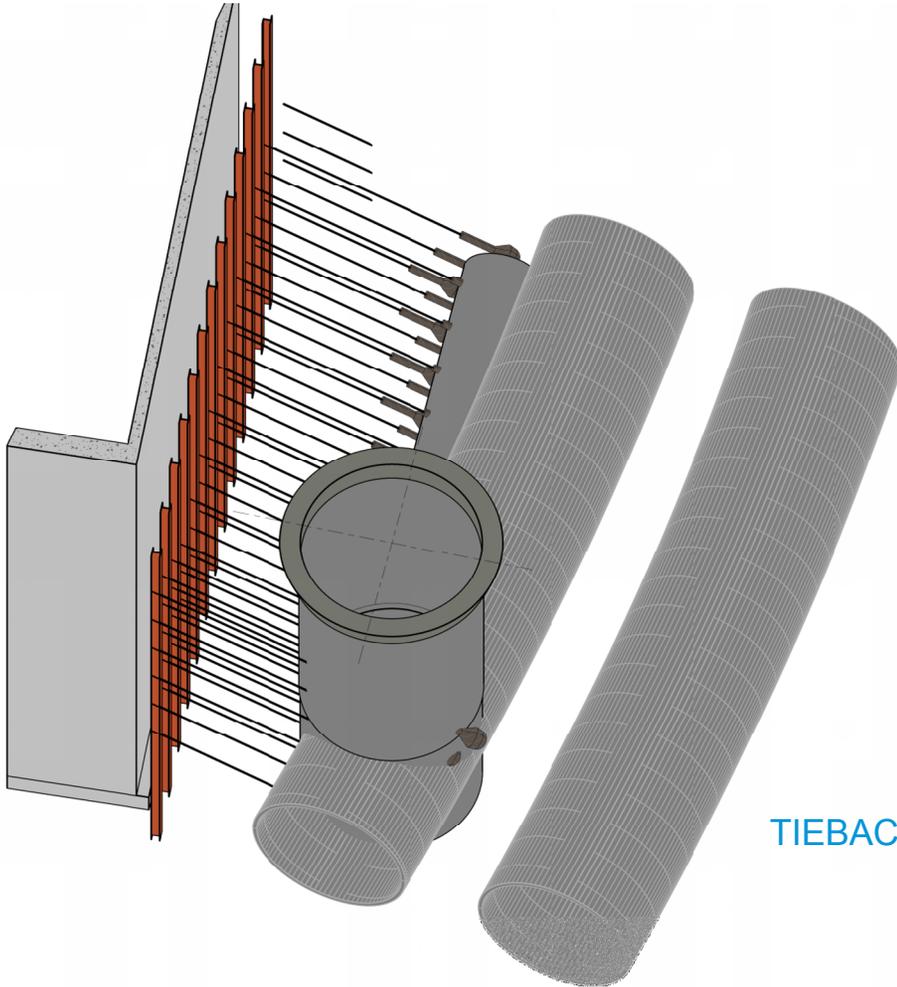
BORED TUNNELS

Civil 3D with Revit Models



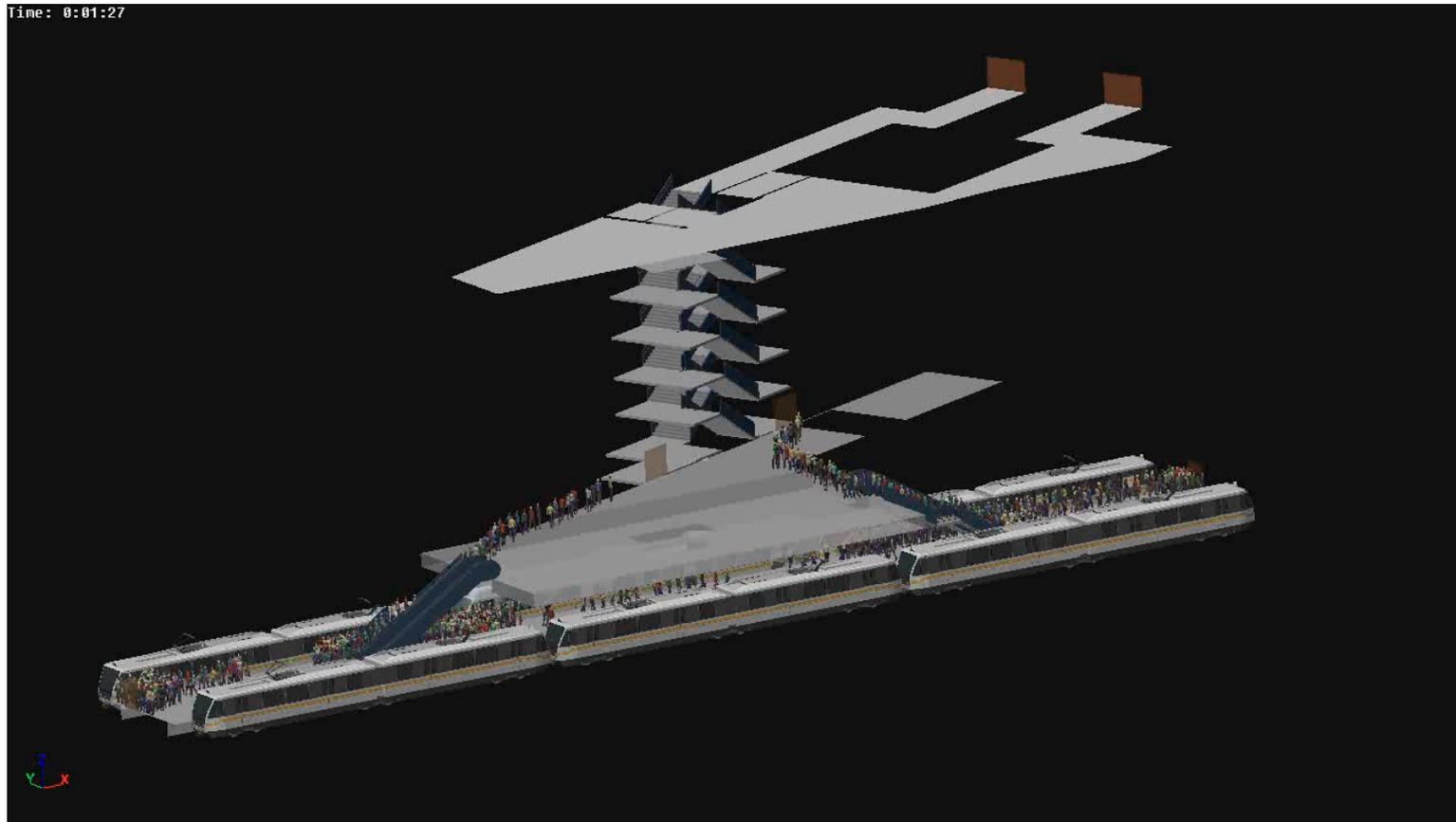
WYE STRUCTURE

Civil 3D with Revit Models



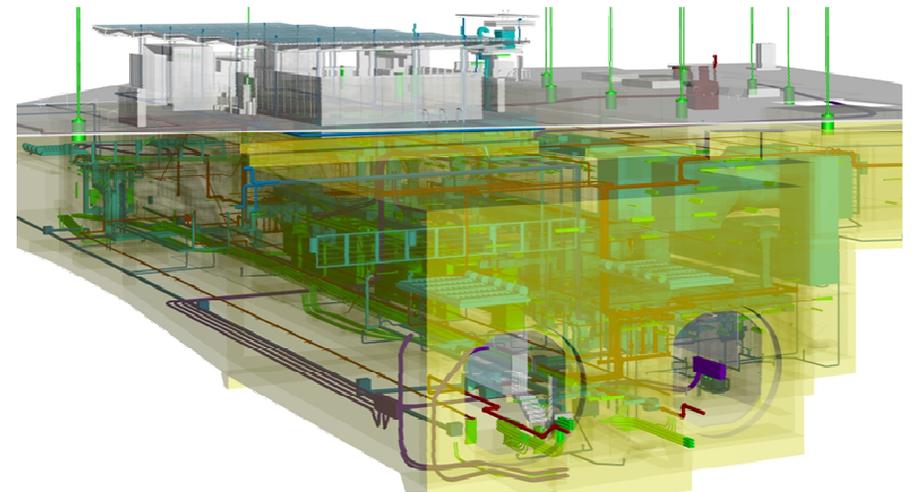
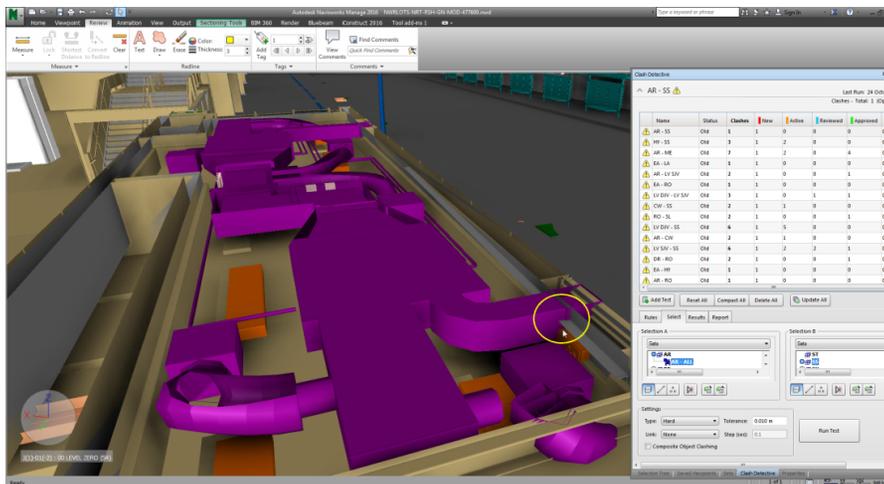
TIEBACK REMOVAL

Computational Fluid Dynamics (CFD) Analysis

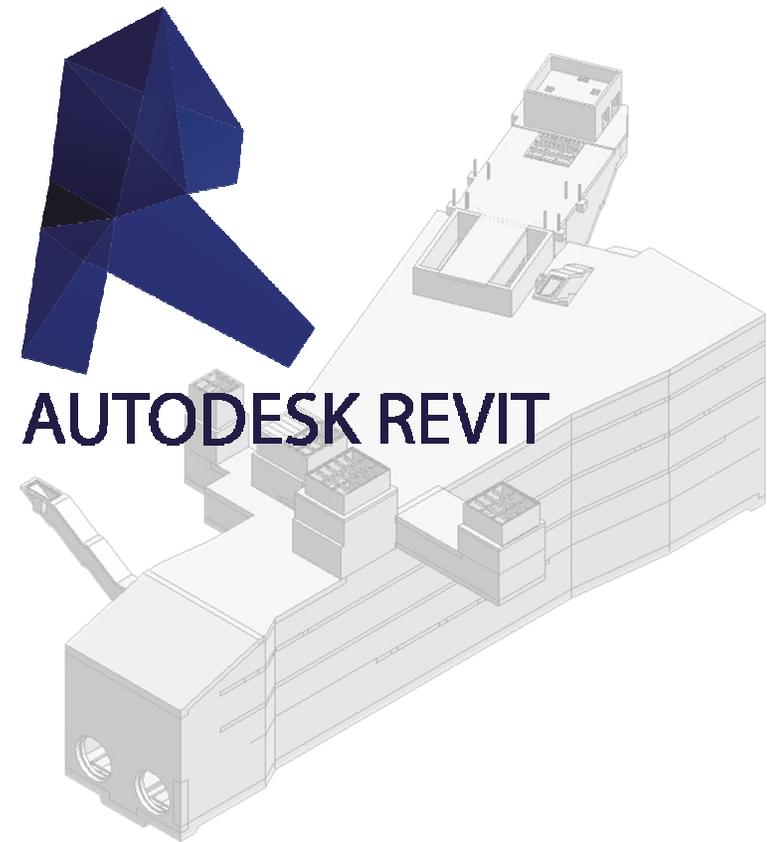


Navisworks Coordination

- Design resolutions with clash detection
 - Clash reports are shared, reviewed and returned with resolutions and comments
 - Design coordination workshops



Understand the Revit Limitations



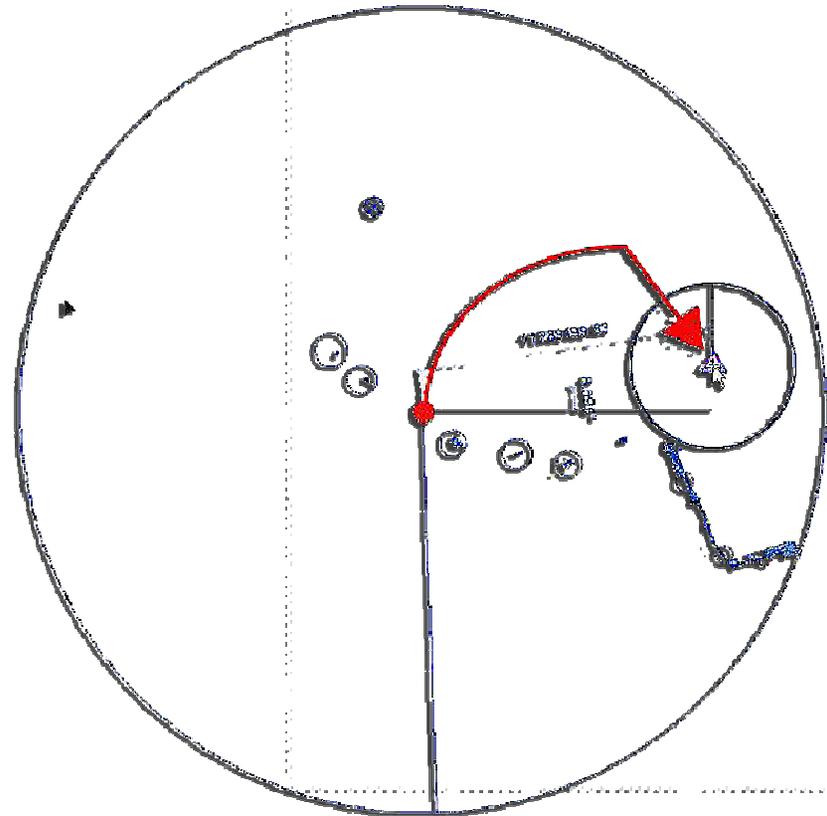
The Revit Coordinates

LIMITATION:

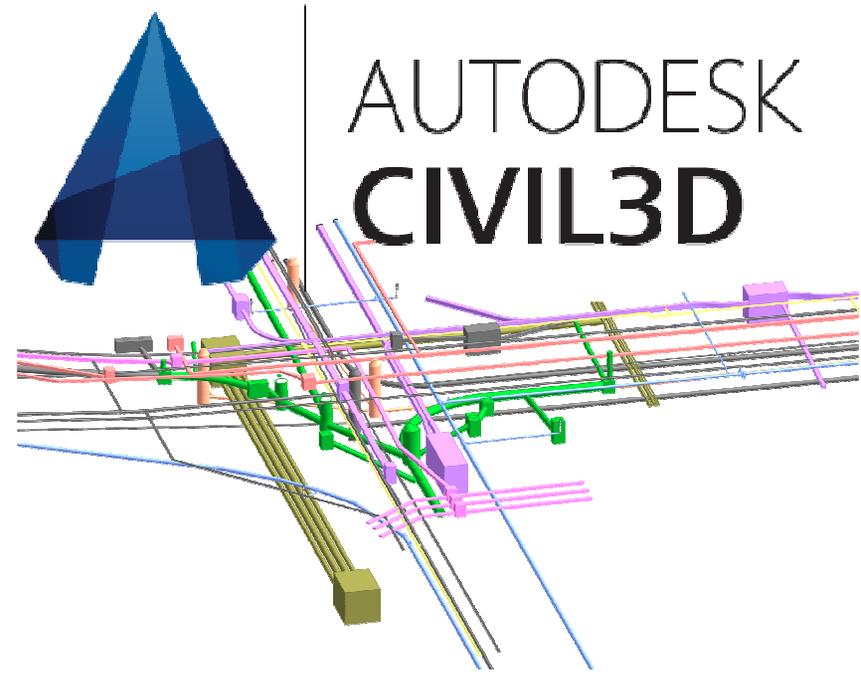
- **Revit 2014** has a **20 mile limit**
 - This means all data created more than 20 miles away from the project origin point is subject to data loss or error

CHALLENGE:

- **the original survey file > 20 miles**
 - A process had to be created so all data fits within the 20 mile limit

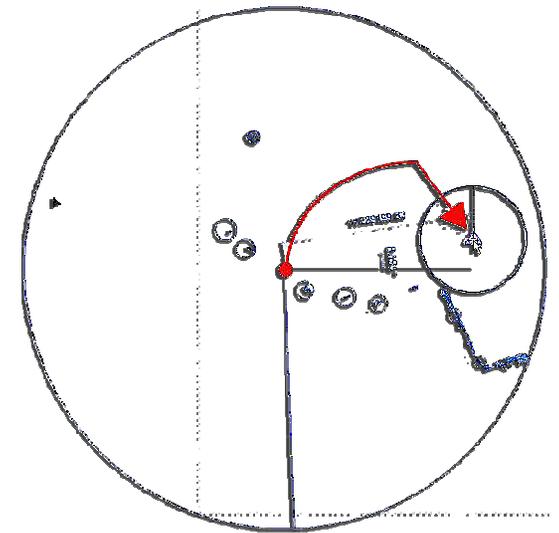
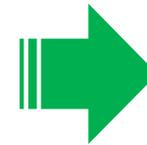
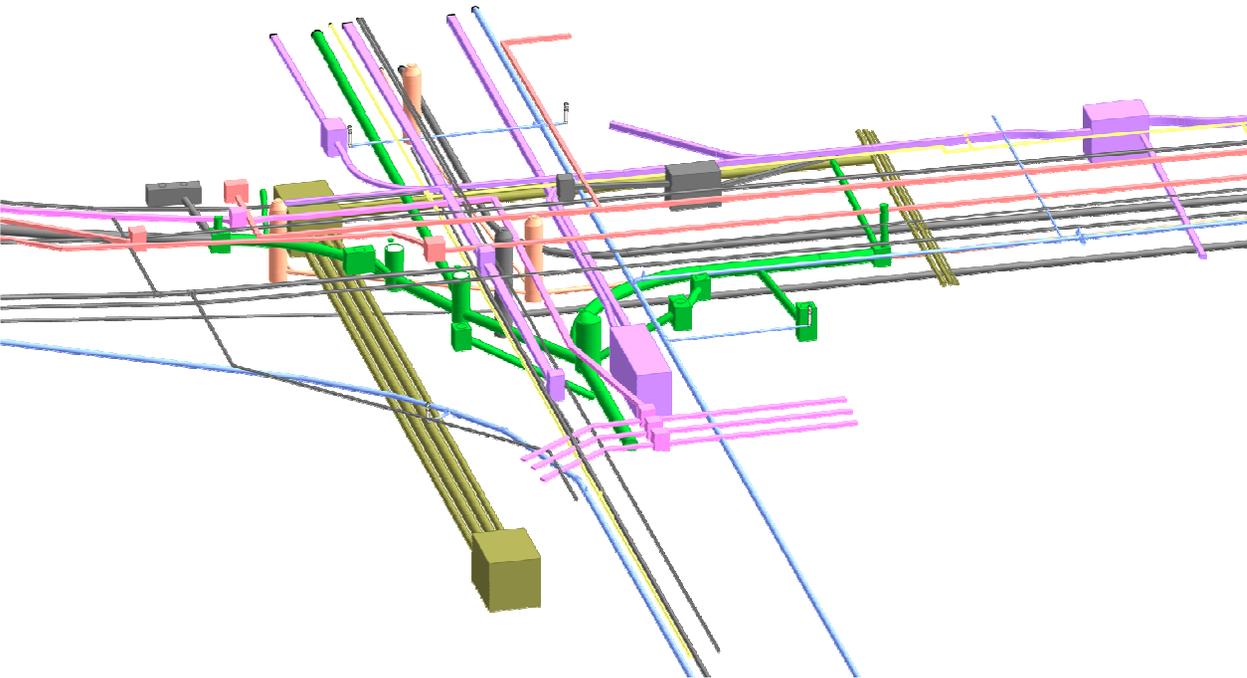


Bringing Civil 3D Content into Revit



Civil 3D to Revit Workflow

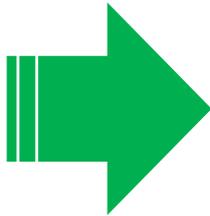
- Translation process:
 - All Civil 3D files needed to be copied and manually moved to the new Revit origin point



Shared Xrefs



- All Civil 3D data



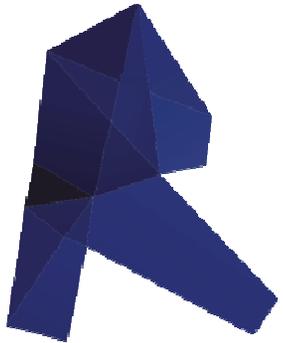
- Translated for Revit

The screenshot displays the ProjectWise Explorer V8i (SELECTseries 4) interface. The left pane shows a hierarchical tree structure of folders and files, including '294646-REGIONAL CONNECTOR' and 'Shared Xref'. The main pane shows a list of files with columns for Name, Description, Out to, Node, File Updated By, File Updated, and Version. The file '14581TPO-Bore Holes_REVIT.dwg' is highlighted in blue. Below the list, the 'Document Properties' tab is active, showing a table with columns for Property name, Property value, and Description.

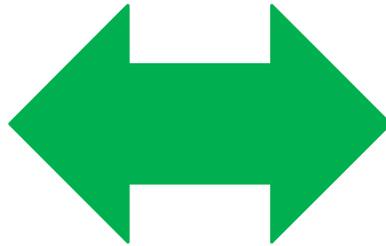
Name	Description	Out to	Node	File Updated By	File Updated	Version
14581TPO-1st Street_REVIT.dwg	New Survey - 1st St & Alameda St (SHOOFLY AREA)			sta64949	2/8/2015 10:29:20 PM	
14581TPO-Bore Holes_REVIT.dwg	New Survey - Bore Holes			sta64949	2/9/2015 11:19:53 AM	
14581TPO-Dunn Bsmnt(SR-062)_REVIT.dwg	New Survey - Tishman Building Basement			sta64949	6/17/2015 8:04:38 PM	
14581TPO-E_1st Street_REVIT.dwg	New Survey - E 1st St & Vignes St			sta64949	2/8/2015 10:29:22 PM	
14581TPO-Gold Line Wall(SR-025)_REVIT.dwg	New Survey - Gold Line MSE Wall			sta64949	6/17/2015 8:47:47 PM	
14581TPO-Hope Street_REVIT.dwg	New Survey - 2ND/HOPE STATION Area			sta64949	2/8/2015 10:29:24 PM	
14581TPO-LA Times-bsmt_REVIT.dwg	New Survey - LA Times Basement			sta64949	2/9/2015 11:45:50 AM	
14581TPO-Little Tokyo_REVIT.dwg	New Survey - Little Tokyo Platform			sta64949	2/8/2015 10:29:26 PM	
14581TPO-N_Alameda Street_REVIT.dwg	New Survey - Alameda St and Temple St w/ Little Tokyo Station			sta64949	6/18/2015 1:51:25 PM	A.001
14581TPO-Red Line Rail_REVIT.dwg	New Survey - Red Line Tunnels			sta64949	6/22/2015 8:53:03 PM	
14581TPO-S_Alameda Street_REVIT.dwg	New Survey - 1ST/CENTRAL STATION Area	Jeff.Kim	2015...	sta64949	2/8/2015 10:29:30 PM	
14581TPO-S_Flower Street_REVIT.dwg	New Survey - Flower St from 7th to 4th			sta64949	6/17/2015 8:01:02 PM	A.001
14581TPO-W_2nd Street_REVIT.dwg	New Survey - 2ND/BROADWAY STATION Area			sta64949	2/8/2015 10:29:02 PM	
14581_SR-023 (W,2nd Tunnel Portals asbtl).dwg	New Survey - 2nd Street Tunnel Portals			sta64949	5/13/2015 10:58:41 PM	
294646-DU03-Y-0020_REVIT.dwg	2D SEM Tunnel Section Sketch			sta64949	2/23/2016 10:09:13 PM	
294646-DU05-C-0515_REVIT.dwg	2D Planimetric - Segment B Roadway Base Bumpout			sta64949	4/23/2015 5:50:16 PM	
294646-DU05_U_0052_REVIT.dwg	2D Planimetric - Alameda Wye Fan Plant Room ROW Impacts			sta64949	10/5/2015 7:35:44 PM	
2nd and Hope station, Sewer and SD POC_REVIT.dwg	2nd and Hope station, Sewer and SD POC_REVIT			dum48810	8/8/2016 12:41:01 PM	
C0980TP111_BROADWAY_REVIT.dwg	2D Planimetric - TP Equipment Layout for Broadway Disconnect Rm			sta64949	4/20/2016 9:10:00 AM	
C0980TP120_2ND HOPE_REVIT.dwg	2D Planimetric - TP Equipment Layout for Hope			sta64949	3/3/2016 9:23:45 PM	C.001
C0980TP310_BROADWAY_REVIT.dwg	2D Planimetric - TP Equipment Layout for Broadway			sta64949	3/2/2016 2:11:56 PM	C.002
C0980TP410_CENTRAL_REVIT.dwg	2D Planimetric - TP Equipment Layout for Central			sta64949	11/13/2015 12:00:21 PM	C.002
C0980_A_Z_0501_REVIT.dwg	2D Planimetric - Little Tokyo South Public Entrance with Ramp			sta64949	10/15/2015 3:31:06 PM	
C0980_CD_0502_REVIT.dwg	Proposed Drainage 1st & Central Station			sta64949	1/6/2016 7:47:08 PM	
C0980_CD_0503_REVIT.dwg	Proposed Drainage 2nd & Broadway Station			dum48810	6/14/2016 5:22:50 PM	C.002
C0980_CD_B_0602_REVIT.dwg	2D Planimetric - 2nd/Hope Station Drainage			sta64949	3/4/2016 2:30:15 PM	C.001
C0980_CS_0401_HOPE_REVIT.dwg	3D Surface - Proposed Roadway Grading for HOPE STATION			sta64949	2/14/2016 1:46:35 PM	C.001
C0980_CS_0501_BROADWAY_REVIT.dwg	3D Surface - Proposed Roadway Grading for BROADWAY STATION			sta64949	3/30/2016 7:06:18 PM	C.001
C0980_CS_0501_CENTRAL_REVIT.dwg	3D Surface - Proposed Roadway Grading for CENTRAL STATION (Tiger ...			sta64949	1/5/2016 2:47:16 PM	C.004
C0980_CS_0601_HOPE_REVIT.dwg	3D Surface - Proposed Plaza Grading for HOPE STATION			sta64949	2/14/2016 1:47:19 AM	C.001
C0980_CS_0601_HOPE_SITE_REVIT.dwg	3D Surface - Proposed West Site Grading for HOPE STATION			sta64949	2/14/2016 1:46:54 AM	C.001
C0980_CS_0701_BROADWAY_REVIT.dwg	3D Surface - Proposed Plaza Grading for BROADWAY STATION			dum48810	6/20/2016 8:00:41 PM	C.003
C0980_CS_0801_CENTRAL_REVIT.dwg	3D Surface - Proposed Plaza Grading for CENTRAL STATION			sta64949	1/5/2016 2:36:41 PM	C.003
C0980_CS_A_0401_HOPE_REVIT.dwg	2D Planimetric - Sidewalks and Curbs for HOPE STATION			sta64949	2/14/2016 1:46:19 AM	C.001
C0980_CS_A_0501_BROADWAY_REVIT.dwg	2D Planimetric - Sidewalks and Curbs for BROADWAY STATION			sta64949	3/30/2016 7:06:08 PM	C.001
C0980_CS_A_0550_CENTRAL_REVIT.dwg	2D Planimetric - Sidewalks and Curbs for CENTRAL STATION (Tiger Gra...			sta64949	11/9/2015 12:27:03 PM	C.002

Property name	Property value	Property name	Property value
Name	14581TPO-Bore Holes_REVIT.dwg	Description	New Survey - Bore Holes

Establish Information Sharing Process

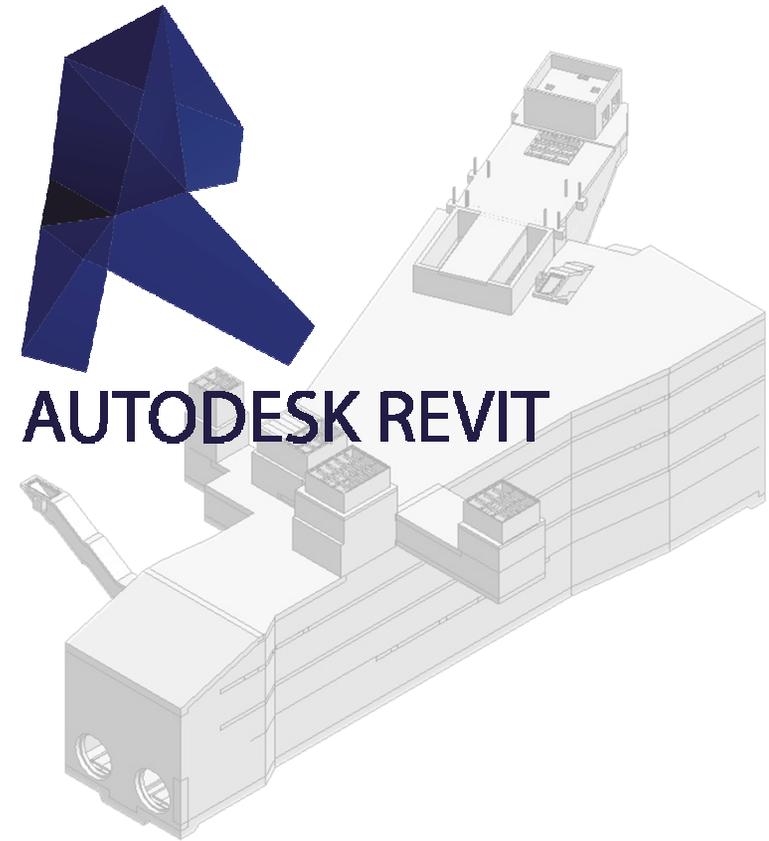


AUTODESK REVIT



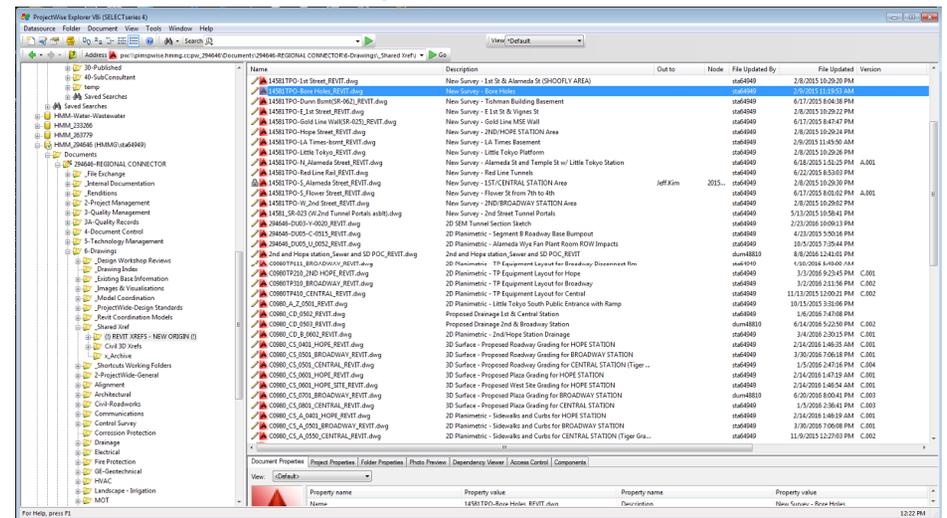
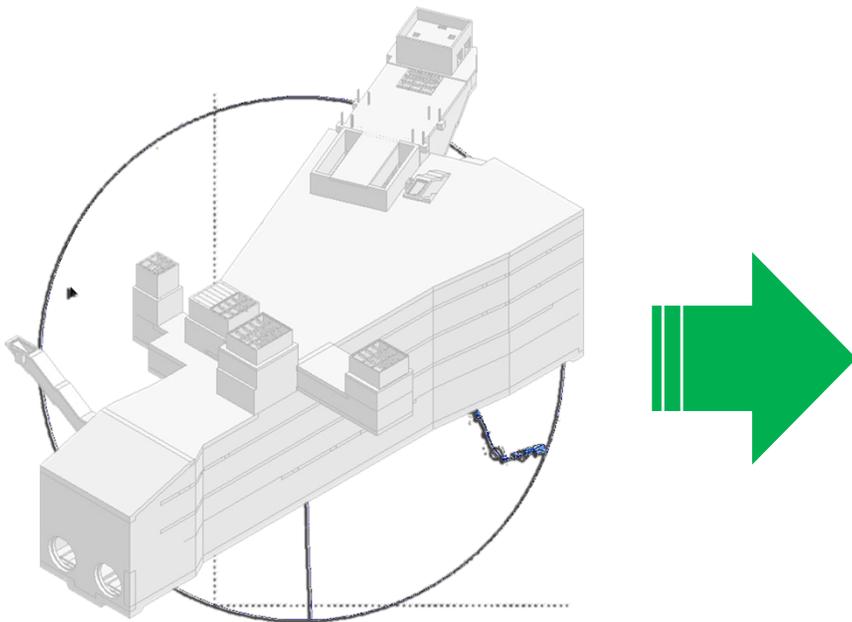
AUTODESK
CIVIL3D

Bringing Revit Content into Civil 3D



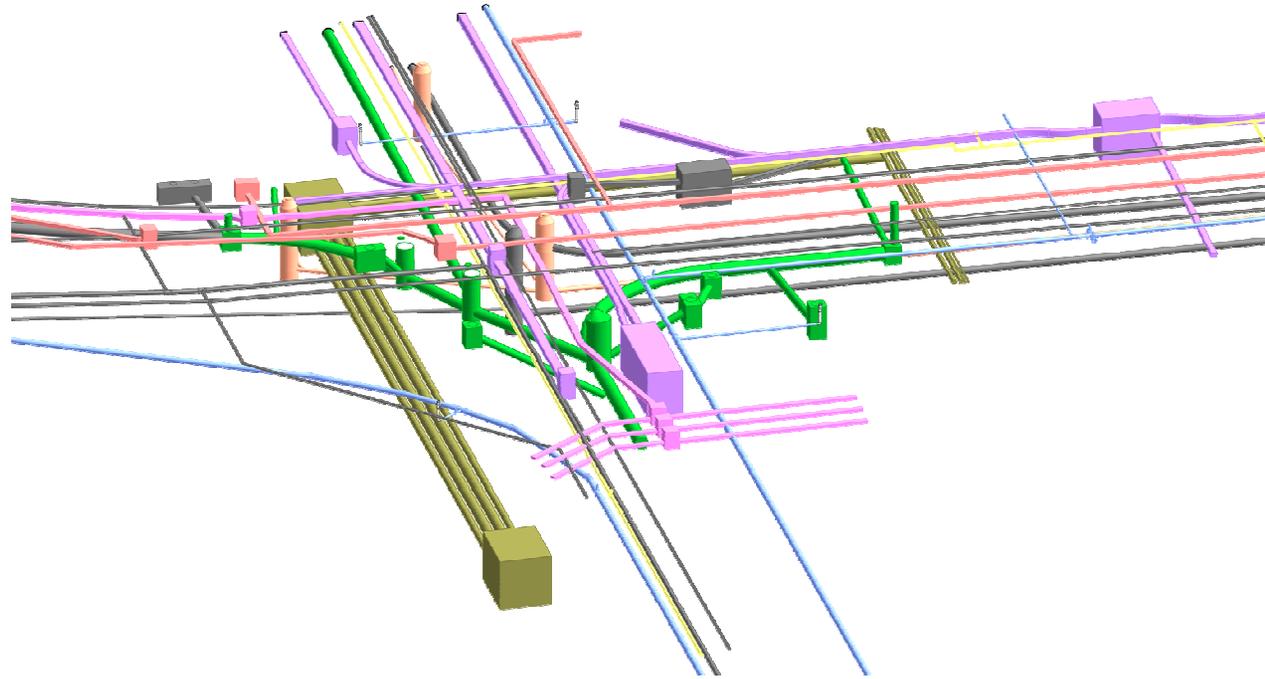
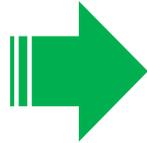
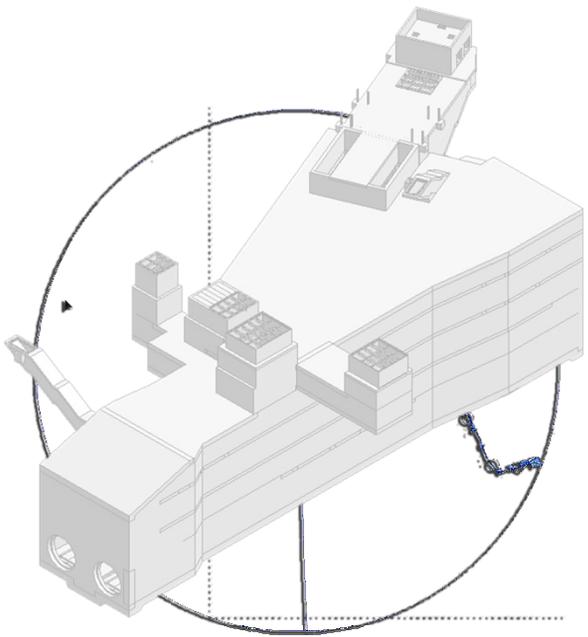
Revit to Civil 3D Workflow

- Revit Exports
 - Create 3D and 2D .dwg exports updated weekly and/or daily

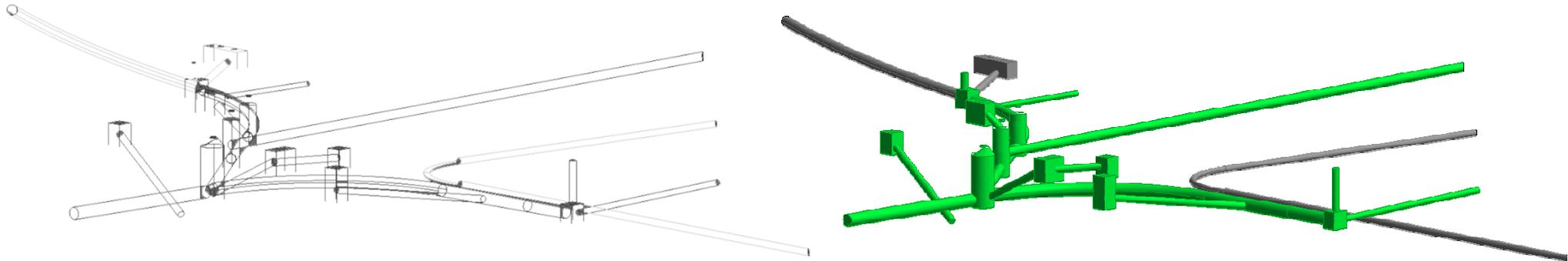


Revit to Civil 3D Workflow

- Translation process:
 - All Revit files had to be inserted into Civil 3D at the new Revit origin point



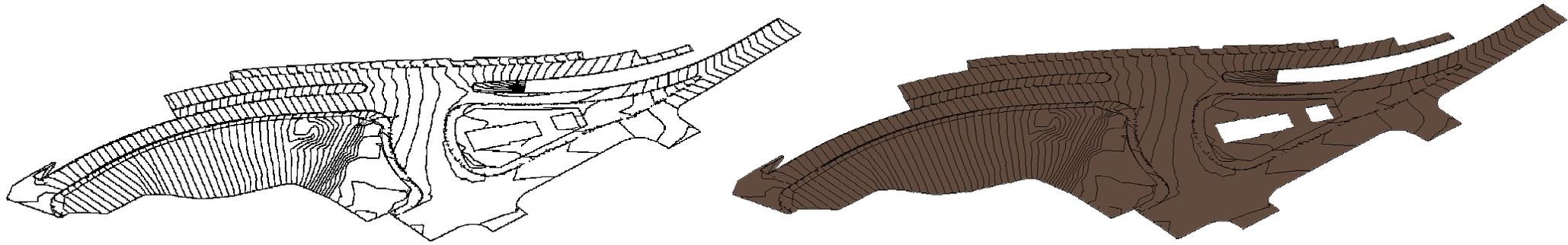
Evolving Workflows



PIPE NETWORKS

- Adjustments:
 - Pipe networks to be split with worksets by discipline
 - Insert the pipe network file into a Revit family
 - Create master Revit files per area for existing, proposed, and relocated
 - 9 utilities Revit files: 3 stations with 3 types of utilities each

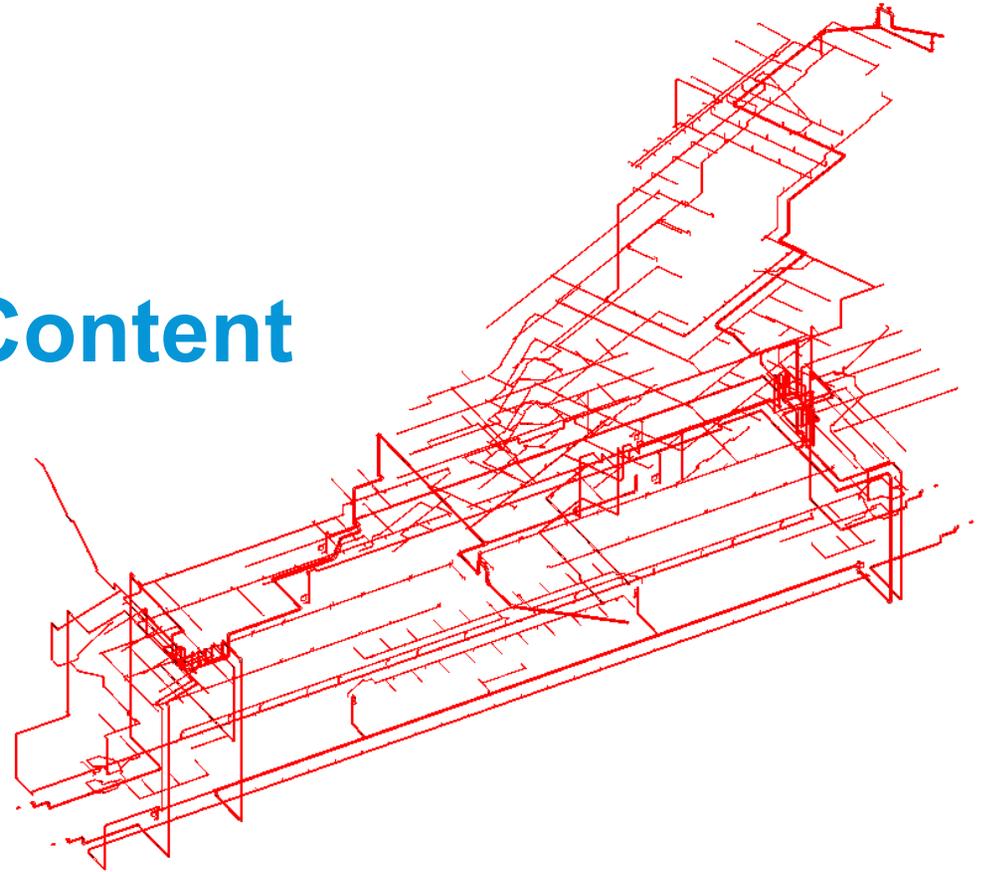
Evolving Workflows



TOPOSURFACES

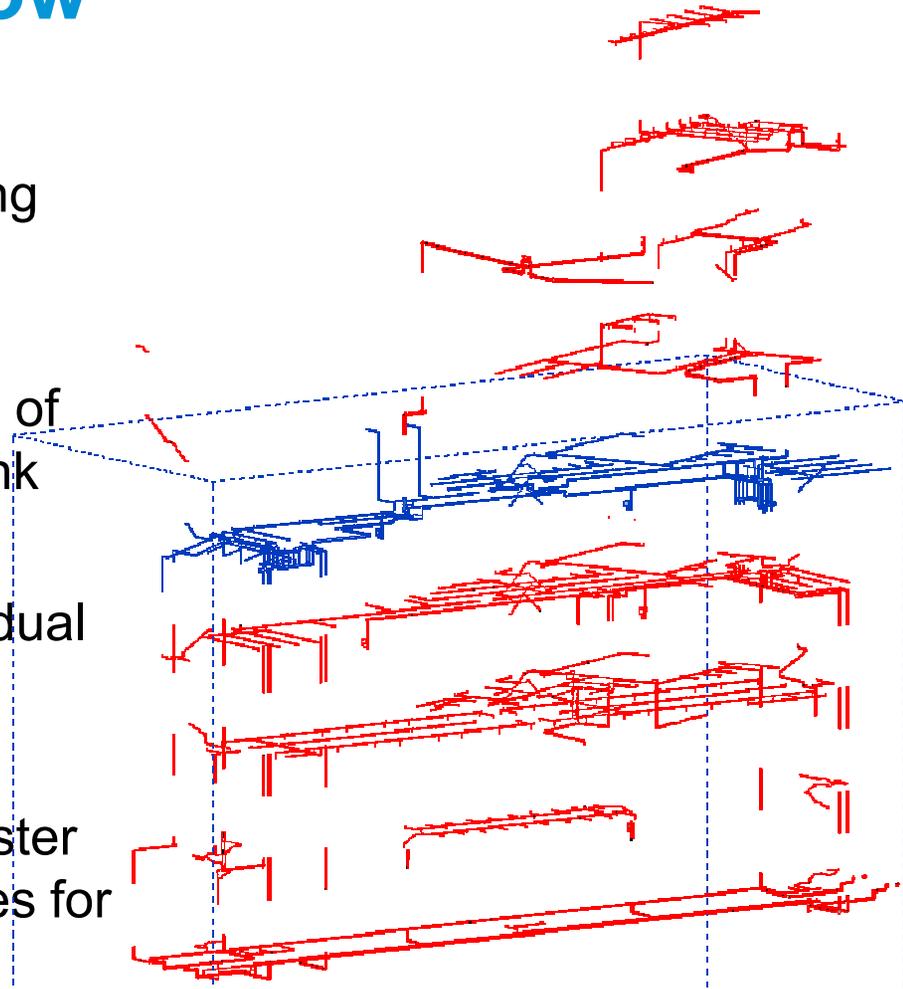
- Adjustments:
 - Toposurfaces split into Roadway and Plaza grading worksets
 - Generate Revit toposurface from Civil 3D surface
 - Create master Revit files for all surfaces

Bringing AutoSprink Content into Revit



AutoSprink to Revit Workflow

- Fire protection design completed using AutoSprink design software
- Individual .mrv files, one file per level of the station, generated from AutoSprink
- Each .mrv file imported into an individual Revit file
- Individual Revit files linked into a master Revit file, used by the other disciplines for coordination



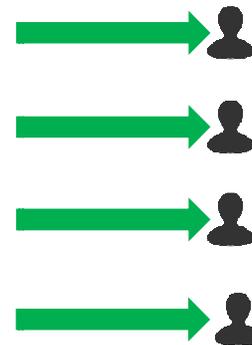
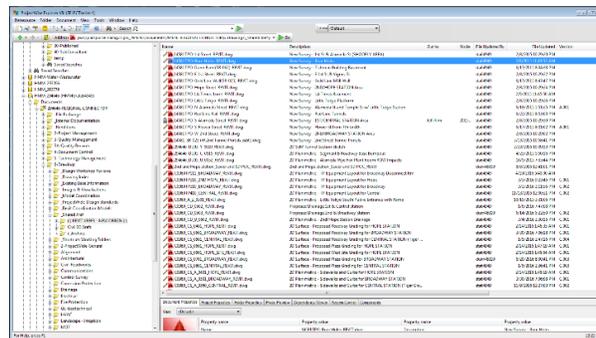
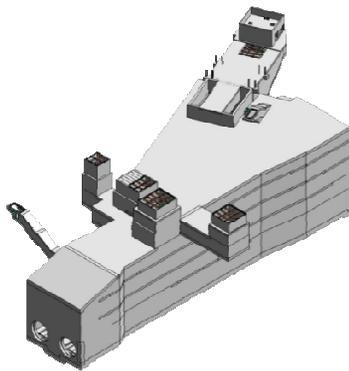


Revit and ProjectWise Workflow



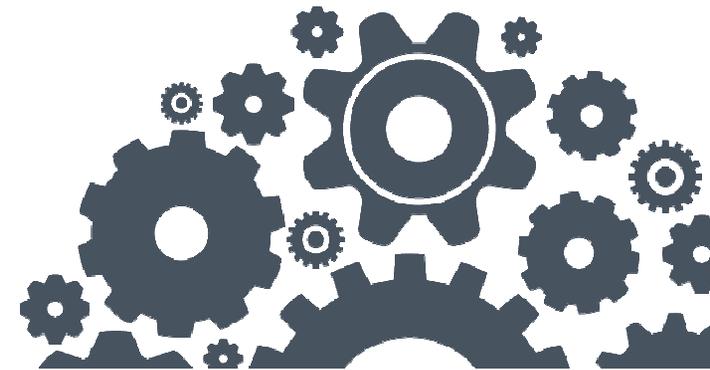
Revit to ProjectWise Workflow

- Revit and ProjectWise are not known for working well together, especially on a project of this scale
- Most of models were moved to a local server to maximize performance and minimize bandwidth latency
 - Work in progress models on the local server
 - Models uploaded in ProjectWise daily, for better design coordination
 - Some live models with all shared models in ProjectWise



How Has the Technology Helped?

- All disciplines were able to reference other discipline models for design coordination
- Model changes were captured in all drawings simultaneously (plans, sections, elevations, details)
- Conflict resolution was expedited with the ability to see elements in 3D
- Multiple users work in a single model, increasing efficiency



Issues and Their Resolution

- **Issue: ProjectWise and Revit are not know to work well together, especially on a project this scale**
 - Resolution: 13 of the 15 Revit models were moved from PW to a local server to maximize performance and minimize bandwidth latency
- **Issue: Civil 3D cannot reference Revit models**
 - Resolution: A 3D .dwg export system was created, so design information was interchangeable between Revit and Civil 3D (still required manual sync once or twice a week)
- **Issue: Multiple users in multiple offices with different approaches, not always aligned with the team's rules**
 - Resolution: Strong project office based BIM/CAD management team, constant “policing”, ongoing training

The Future of the Unicorn



The Future of the Unicorn

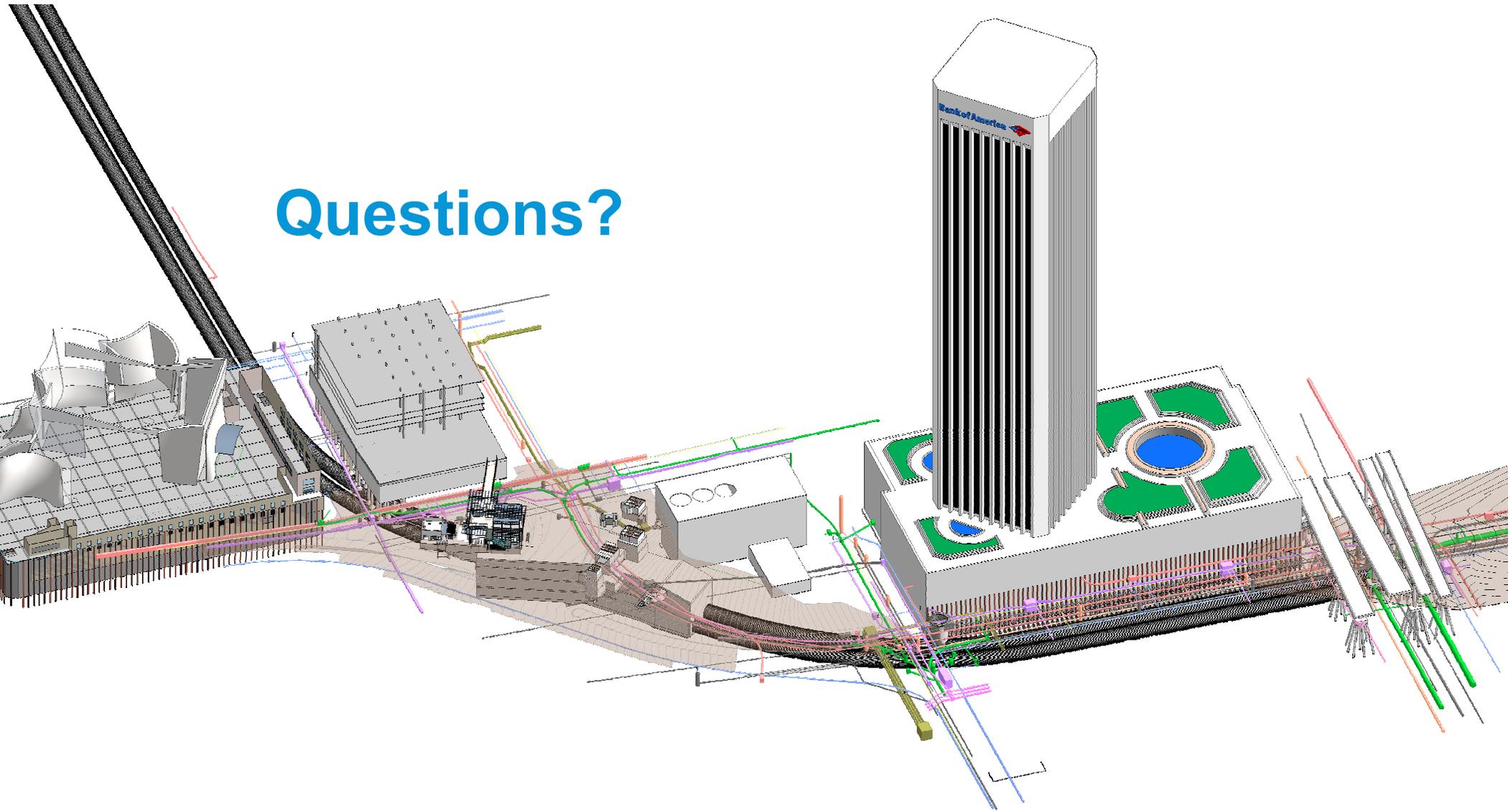
- What is the future of the “Unicorn”?
- Will the 20 mile limit be removed?
- Do Civil 3D and Revit have a future together?
- Can the files be interchangeable?
- Revit and ProjectWise can work well together
- What do YOU think?

How did I do?

- Your class feedback is critical. Fill out a **class survey** now.
- Use the AU mobile app or fill out a class survey online.
- Give feedback after each session.
- AU speakers will get feedback in real-time.
- **Your feedback results in better classes and a better AU experience.**



Questions?





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